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The organizing effect of a simulation game experienced in advance of reception learning of economics

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in appendix S. In drawing up the material and the test, textbooks were examined, content subject specialists were consulted and specified behavioural objectives were tested.

The textbooks that were consulted are: Stonier and Hague (1972), Lipsey (1972), Samuelson (1973) and Mansfield (1977).

The test items were scrutinised independently by three colleagues: Dr T Watkins, professor of economics, San José University, California; and Messrs R Jones and B Bloch, lecturers, respectively in business economics and economics at the University of the Witwatersrand. On their advice, certain questions were reworded by the researcher to avoid inaccuracies and ambiguities.

3.2.2 Reliability of the pre post/test instrument

The pre-post test is criterion referenced. It is scored objectively. The scoring is objective in that the questions have specifiable "correct" answers agreed to as described above and set down in advance of the marking of the test. Since the scores attained by individual students are criterion referenced, they are interpreted on the basis of absolute criteria (i.e. either correct or incorrect) and not as in norm referenced testing, relative to the performance of all the students tested.

The test was developed from an earlier version used in a feasibility study of the experimental design which was performed in September, 1981, at Townview High School, Krugersdorp. To avoid possible

'floor' and 'ceiling' effects, questions were aimed at levels of difficulty judged predictively to lie in the mid-to-lower ranges of the pre/post test scale. This is necessary to make allowance for potential gains to be accommodated by the post-test.

External validity beyond the specific course and population directly involved, is not intended in this research. Standardisation of the test to norms of any wider population is therefore not necessary. It is what Ausubel and Robinson (1969 p 579) call a 'teacher-made' test, 'designed to measure the specific outcomes of a particular course taught in a particular year to a particular class'. The test is not invalid, however, in replicating the experiment with a different class, since it is criterion and not norm referenced.

3.3 Control of the Variables

3.3.1 The preparatory learning material

In preparation for the discovery learning experience of the simulation game, the experimental and control students combine for two expository lessons. The objectives of these lessons, which aim to familiarise the students with ideas they will encounter in the simulation, are shown in appendix G. It is thereby assumed that the simulation will be meaningfully experienced.

3.3.2 The simulation material and the advance organizer

3.3.2.1 Discovery learning material

The simulation game, Trebedias Island (Simile II 1977), is modified to incorporate the organizer within the learning material of the experimental group students. By a meaningful discovery learning process, it is expected that these students will assimilate and retain the organizing concept. It is a general concept (the differing responsiveness of quantities demanded to changes in price) and not simply the term 'elasticity' or memorization of its definition, that they are expected to learn.

The control subjects participate in all the lectures and the simulation game together with the experimental subjects, but they do not encounter the advance organizer material in the simulation. In order to isolate the independent variable (i.e. the organizer) from the control subjects, students are allocated to "firms" so that experimental and control students work in different groups. The students are advised not to disclose the information they are given to opposing firms and that it is not in their interests as competitors to do so. As the organizing material is not part of the original Trebidias Island simulation game, the motivation and competitive standing of the control subjects is not affected. The Hawthorne effect of the experiment is the same for all the subjects.

3.3.2.2 The 'organizer' material

The organizer material is shown in appendix I. It is formed by a configuration in which a graph and written explanations have been added to the original material of the simulation game. In appendix J, the specific organizing material is shown separately from the material in which it is incorporated.

The graphs represent demand functions of houseowners and businesses on an imaginary island. These two demand curves are annotated to show in which sections their elasticities are respectively equal to zero and by comparison greater than one.

The graphs are accompanied by verbal descriptions of how changes on the price axis relate to consequently large or small (or zero) changes on the quantity axis.

3.3.3 The Transfer Retention Test

The transfer retention test (quod vide 1.5) as defined by Ausubel and Robinson (1969 p 609), "measures whether a given segment of knowledge is sufficiently stable, clear and well-organized to serve as a basis for new sequentially related learning tasks and problem solving". In this experiment, sequential transfer is intended (quod vide 2.15), but whether or not problem solving ensues is not of consequence.

The transfer retention test, shown in appendix R, has two questions. The first question is intended simply as an introductory exercise. The second question actually tests for retention of the organizer concept. To pass the test, the student is required four days after the simulation, to reproduce the shapes of the two curves. The student must indicate on the graph the sections of the curves where the measure of elasticity has a zero value and where the elasticity measures greater than one.

3.3.4 The Subsumptive Reception Learning Material

The reception learning material is presented orally in two lectures on 'price elasticity of demand'. The learning objectives are set out in appendix S. The conceptual context of these lectures is subsumptive to the organizing concept. The pre/post test instrument measures each student's gain in achievement of these objectives. All the students participate together as a class for the subsumptive reception learning material, as previously for the preparatory learning material.

3.3.5 Matched Pairs Allocated to Control and Experimental Groups

Student pairs are matched in the first instance on their pretest achievement scores. Students with exceptional variables in the following respects are eliminated from the experimental and control groups: scores on mental alertness and abstract reasoning, ages, an odd number of either sex, or any variable that cannot be matched. Any students eliminated in this way from the experimental and control groups, do still participate in the learning programme with all the other students in the class. None is aware of his or her allocation for experimental treatment.

Since each correct answer in the pre/post test instrument scores 4 marks, a tolerance of less than 4 (i.e. a difference of up to 3 in the matching of prescores) is considered to be sufficiently "well matched" on the achievement variable. The procedure for matching on prescores commences with the two highest compatible scores, followed by the next two in rank, down to the lowest two scores.

The pairs are then coded alphabetically from the highest ranking pair down to the pair with the lowest scores. (Appendix C) Dividing of the matched students between control and experimental groups does not occur before all the pairs are allocated between two neutral groups, temporarily designated as groups (a) and (b). Care is taken in matching pairs that an equal number of each sex is allotted to the two groups. Groups (a) and (b) are then balanced as equally as possible on the stanine scores for mental alertness abstract reasoning, without upsetting the balance of the prescore means of the two groups. Finally, the two groups are randomly designated, one as the control and the other as the experimental treatment group.

Standardized tests used to obtain mental alertness and abstract reasoning stanine scores are: the NIPR Mental Alertness Test of the High Level Battery B/75, fourth edition, September, 1972; and Raven's Matrices Test of Abstract Reasoning.

3.4 Treatment of the Research Data

For research in which it is uncertain as to how the basic variable is distributed, distribution-free or non-parametric tests have been devised. A more elaborate variation of the sign test, the Wilcoxon matched-pairs signed-rank test, is suited to a research design such as this provided that the pairs are well matched. Alternatively, a rank sum test, the Mann-Whitney U-test could be used. Writers consulted on the use of these tests are Downie and Heath (1965 pp 235-244), Robson (1973 pp 106-114), Runyon and Haber (1980 pp 333-341), Mulder (1962 pp 158-163) and Langley (1968 pp 179-182).

Non-parametric tests such as these, including the median test and the chi squared test, make no assumptions about the distribution of the basic variable and they do not utilize distribution parameters. They are based on observed frequencies and not on sample estimates of population parameters. A chi squared test can also be applied, whatever the distribution of the basic variable, without making any pre-empting assumptions about the type of frequency distribution (normal, Poisson, etc.) to which the basic variable actually belongs.

3.4.1 Summary of the research design

To recapitulate the research design makes use of two matched groups of equal numbers of subjects. These two groups together constitute the whole population of the experiment.

The groups are matched in pairs randomly allocated to control and experimental groups on the basis of independent scores of each subject in an achievement pretest of the dependent variable. The dependent variable is the learning and retention of certain reception material and is measured by the posttest. Improvement, or the gain in learning and retention, is measured by the differences between the post and pretest scores for each of the subjects. Improvement, ascribed to the independent experimental variable, is tested by comparing the gains of the experimental group with those of the control group. The null hypothesis is that there are no significant differences between the gains in the scores of the experimental group and the control group.

A parametric test, the t-test can be used to determine whether the mean of the differences between pairs of observations is significantly different from zero, that is provided it is known that the differences are normally distributed. Where a normal distribution is not certain, as in this research design, the sign test offers a possible alternative treatment for the data.

3.4.2 The sign test for non-parametric data

Runyon and Haber (1980 pp 338) say that 'the assumptions underlying the use of the sign test are that the pairs of measurements must be independent of each other and that these measurements must represent, at least, ordinal scaling'.

The sign test however has the limitation that it simply uses information as to the direction of the differences between pairs. It eliminates any quantitative information as to the size of the differences. In this research it is possible to rank the differences of size in gains ordinally and to observe the direction of their signs.

3.4.3 The Wilcoxon matched-pairs sign-rank test

This Wilcoxon test is more powerful than the sign test because it utilizes the quantitative information inherent in the ranking of the differences, as well as the positive or negative direction of the pairs' differences.

The test is demonstrated in Table I, using hypothetical data.

MATCHED PAIR	GAINS ON PRETEST SCORES (POSTTEST LESS PRETEST) EXPERIMENTAL PERCENTAGES GAINS e	CONTROL PERCENTAGE GAINS c	DIFFERENCE (e - c)	RANK OF DIFFERENCE (+)	RANKS WITH SMALLER SUM (-)
A	85 - 70 = 15	89 - 80 = 9	+ 6	17,5	
B	80 - 69 = 11	74 - 69 = 5	+ 6	17,5	
C	76 - 65 = 11	68 - 60 = 8	+ 3	13,5	
D	72 - 62 = 10	68 - 62 = 6	+ 4	16	
E	71 - 61 = 10	65 - 58 = 7	+ 3	13,5	
F	67 - 58 = 9	68 - 57 = 11	- 2		9,5
G	64 - 55 = 9	64 - 56 = 8	+ 1	3,5	
H	62 - 53 = 9	60 - 54 = 6	+ 3	13,5	
I	59 - 51 = 8	55 - 50 = 5	+ 3	13,5	
J	56 - 48 = 8	53 - 47 = 6	+ 2	9,5	
K	54 - 47 = 7	55 - 47 = 8	- 1		3,5
L	53 - 47 = 6	50 - 45 = 5	+ 1	3,5	
M	50 - 44 = 6	46 - 42 = 4	+ 2	9,5	
N	41 - 36 = 5	44 - 40 = 4	+ 1	3,5	
O	39 - 35 = 4	38 - 35 = 3	+ 1	3,5	
P	36 - 33 = 3	36 - 34 = 2	+ 1	3,5	
Q	34 - 31 = 3	34 - 30 = 4	- 1		3,5
R	32 - 29 = 3	31 - 30 = 1	+ 2	9,5	
S	28 - 26 = 2	28 - 26 = 2	(0)		
			N = 18		T = 16,5

TABLE I: Wilcoxon Matched-Pairs Signed-Ranks Test, illustrated using hypothetical test scores.

On the null hypothesis that the independent variable will cause no significant improvement to the dependent variable; as revealed by comparison of differences in gains between the experimental (e) and control (c) groups; it is to be expected that the number of matched pairs in which $e > c$ is about the same as the number of pairs for which $e < c$. If the differences in gains for each pair are listed, a series of numbers is obtained some of which have a positive sign and some of which are negative, with the occasional tied value of nought. Tied differences are rejected from the number of matched pairs N.

The null hypothesis H_o implies that a sign is equally likely to be positive or negative, hence the frequency of signs is expected to be half positive and half negative. In a two category population, P is defined as the proportion of cases in one class and the proportion of the other class as $Q = 1 - P$. So, assuming H_o, the probability of any difference being positive is equal to the probability that it will be negative. Hence $P = Q = \frac{1}{2}$.

The Wilcoxon test accommodates the size of the differences as well as their signs, by allocating rank orders. Applying the two-tailed test, using a table of critical values of T in the Wilcoxon test for paired data, when $N = 18$, the critical values are maxima of 40 at a 0,05 level of confidence and 27 at a 0,01 level. The calculated value $T = 16,5$ in the example shown in Table I, is less than both of these critical values. The null hypothesis would therefore be rejected at a 0,01 level of confidence.

In the last two columns of Table 1, the ranks have been summed according to the sign of the observed differences. The smaller, in this case $\Sigma R(-)$, is taken as the Wilcoxon T statistic.

If as expected in the null hypothesis there were no differences between the two groups, T would equal $\overline{T}$, the mean sum of the ranks. The formula for obtaining $\overline{T}$ is:

$$\overline{T} = \frac{N(N + 1)}{4}$$

In this example:

$$\overline{T} = \frac{18(18 + 1)}{4}$$

$$= \frac{342}{4}$$

$$= 85,5 \qquad (T = 16,5)$$

If the obtained value T differs significantly from $\overline{T}$ the null hypothesis can be rejected. For smaller sums of ranks, that is for values of N between 7 and 25, as is the case in this research, the significance of T may be tested without using the above formula, but by direct reference to a Table of Critical Values of T.

3.4.4 Mann-Whitney U test

The Wilcoxon matched-pairs signed-rank test assumes that the groups are well matched. Should the matching be suspect, the Mann-Whitney U test, also known as the rank sum test, should be used.

Like the Wilcoxon test, the Mann-Whitney test is a non-parametric counterpart of the t-test. It is appropriate for designs with <u>independent subjects</u>. The assumed data in Table I, is used in Table II below, to demonstrate the Mann-Whitney test. For small sample cases - and the samples need not necessarily be of equal size - with not more than 20 observations in either set of scores, the procedure is as follows:

Rank the data (taking both groups together,, as in Table II.

EXPERIMENTAL		CONTROL	
GAIN	RANK	GAIN	RANK
2	3	1	1
3	6½	2	3
3	6½	2	3
3	6½	3	6½
4	10½	4	10½
5	14½	4	10½
6	19	4	10½
6	19	5	14½
7	22½	5	14½
8	26	5	14½
8	26	6	19
9	30½	6	19
9	30½	6	19
9	30½	7	22½
10	33½	8	26
10	33½	8	26
11	36	8	26
11	36	9	30½
15	38	11	36
ΣR_1 =	428½	ΣR_2 =	312½
N_1 =	19	N_2 =	19

COMPUTATION

$$U = N_1N_2 + \frac{N_1(N_1 + 1)}{2} - R_1$$

$$U = 361 + \frac{19 \times 20}{2} - 428\tfrac{1}{2}$$

$$U = 361 + 190 - 428\tfrac{1}{2}$$

$$U = \underline{122}$$

$$U' = N_1N_2 + \frac{N_2(N_2 + 1)}{2} - R_2$$

$$U' = \underline{238\tfrac{1}{2}}$$

<u>Table II</u>: Ranking of gains on pretest score to calculate the Mann-Whitney U.

The formula $U = N_1N_2 - U'$ is used to check the above calculations. The null hypothesis is rejected at a critical value of 0,10 on a two tailed test. The hypothesis could in this case be accepted at a 90 percent level of certainty, on the Mann-Whitney test.

3.4.5 Reasons for selecting Wilcoxon's test

The Wilcoxon matched-pairs sign-rank test is more powerful than the Mann-Whitney U-test. The greater sensitivity of Wilcoxon's test is due to its taking into account not only the direction of differences between the two sets of paired achievement score gains, but also the sizes of the differences between the gains of these pairs. The experimental design enables this feature of the test to be utilized as subject variables are measured independently. According to the null hypothesis there should be no significant difference between the two sets of scores. Any chance differences would accordingly be expected to occur in about equal numbers of plus and minus differences.

The purpose of Wilcoxon's signed ranks test is to compare two random samples of measurements which are matched. The matching, as in this research, may be achieved, as Langley (1968 p 179) says, by careful pairing of members of two sample groups. The pairs are closely matched on achievement prescores. The test used to effect the matching on prescores is the same as is used for the (dependent variable) postscores. If the null hypothesis were true, close correlation could be expected between the matching variable (prescore) and the dependent variable (postscore).

3.4.6 Test for significance of the transfer retention test results

A contingency test devised by Fisher (Langley 1968 pp 292-311) is used to test the significance of the transfer retention test (TRT)

results. This is to ensure, with the aid of the control group TRT results, that the association between the experimental variable and the experimental TRT results is not possibly due entirely to chance.

This test of Fisher's (op cit p 292) is based on his discovery that the exact probability of getting any particular values of a, b, c, and d by chance, in a contingency table such as that shown below, is given by the hypergeometric formula:

$$p = \frac{n_1! \times n_2! \times n_3! \times n_4!}{N! \times a! \times b! \times c! \times d!}$$

! means "factorial"

eg. $6! = 6x5x4x3x2x1 = 720$

FISHER'S CONTINGENCY TABLE:

a	b	n_1
c	d	n_2
n_3	n_4	N

$n_1 = a + b \quad n_2 = c + d$

$n_3 = a + c \quad n_4 = b + d$

$N = n_1 + n_2 = n_3 + n_4$

$N = a + b + c + d$

Figure 8.

3.9 Schedule of the Research and Learning Programme

The sequence of the research procedure (figure 5, section 3.1) with its concomitant learning programme was scheduled from April 19th, to May 24th, 1983. A schedule of the events intervening between the pretest and the posttest is shown in appendix F.

4 THE RESULTS OF THE RESEARCH

4.1 The Allocation of Matched Pairs

The achievement pretest scores are shown with those for mental alertness and abstract reasoning, in appendix B. To maintain confidence of the students, their names were numbered from 1 to 38 and only the numbers are shown.

In the achievement pretest the highest and lowest scores were respectively 64 and 14, out of a total of 112. 'Ceiling' and 'floor' effects were thus avoided. Three students (one male and two females, number .. , 1 and 19 who could not be matched due to extreme variable.. of mental alertness, abstract reasoning or age, were eliminated. There remained 18 female and 17 male subjects. These remaining 35 students, except for one od , and therefore extranumerary male (numbered 28), were matched carefully in pairs. The matching procedure that was followed is set out in section 3.3.5 of this report.

The two groups (a and b in appendix C) were randomly allocated respectively as the control and the experimental group. The extranumerary male student (numbered 28), although unmatched, was allocated to a 'firm' and participated in the simulation, but was not included statistically in the experimental data. The three eliminated students (19, 1 and 9) also participated in the simulation, playing the roles of: investors' representatative, homeowners' representative and businesses' representative, respectively. (The representatives' script is shown in appendix M)

4.2 The Transfer Retention Test (TRT) Results

The results of the transfer retention test appear in appendix E.

After the first performance of the simulation, all with the exception of one control subject (number 15), failed (f) the TRT. After the second encounter with the simulation, subject number 15 failed the TRT in common with the majority of the control subjects.

After the second performance of the simulation, fourteen of the seventeen experimental subjects; and one of the seventeen control subjects passed (p) the TRT. (Number 28 as a supernumerary male was excluded from the control group statistics) Included in the seventeen experimental group passes was subject 17, who failed the TRT, but with coaching subsequently demonstrated that she had acquired the organizing concept. The experimental group subjects (38, 2 and 37) who failed to acquire the organizing concept after coaching, were eliminated with their control group pair mates (6, 3 and 34) respectively in pairs L, P and G. The experimental subjects' results were eliminated from the reception learning phase because their failure of the TRT indicated that subsequent learning could, as for their control group pair mates, not be consequent upon a knowledge of the advance organizer concept. The Wilcoxon matched-pairs signed-rank test (quod vide 3.4.3 and 3.4.5) requires equal numbers of well-matched, randomly allocated, pair mates in each of the control group and the experimental group. Hence, control group pair mates' results also had to be eliminated from the statistics used to test the null hypothesis. The students who passed the TRT were deemed to have attained a sufficiently stable, clear and well organized knowledge of the concept and could therefore be included experimentally in the subsequent stage of receptive learning by subsumption - the dependent variable as measured by the post-test.

Fisher's Test (Langley 1968 pp 292-311) indicates that there was a significant difference between the TRT scores of the experimental and control groups, after the second performance of the simulation. Subject 17 was for this purpose treated as a failure. There is a probability of not more than 1 percent of this result occurring by chance.

The test of the statistical significance of the TRT was calculated as follows:

The frequencies of passes in the second of the TRTs, as shown in appendix E, are substituted for the values a, b, c, and d in Fisher's contingency table (quod vide 3.4.6).

(a)	13	(b)	1	(n_1)	14
(c)	17	(d)	17	(n_2)	34
(n_3)	30	(n_4)	18	N =	48

TABLE III Contingency table of the second TRT scores.

Thirteen (a) of the seventeen (c) experimental subjects passed the TRT. One (b) of the seventeen (d) control subjects passed the TRT.

Fisher's test suggests that the association between the experimental variable (the organizer material) and the TRT scores, is significant (i.e. not entirely due to chance).

Fisher's critical value of d for the observed data is 16 at the 1 percent level of confidence. Since the observed value of d = 17; and 17 > 16, the probability of the observed values occurring by chance (if there were no significant difference or association) is 1 percent or less. This result suggests that the 'discovery learning material' of the simulation game was effective for the experimental group subjects (with some exceptions) in their learning of the organizing concept.

4.3 The Test of the Hypothesis

The post-test scores and concomitant gains on the prescores are shown in appendix E. Applying the Wilcoxon Matched-Pairs Signed-Ranks Test to these data gives the following results:

MATCHED PAIRS*	EXPERIMENTAL GROUP GAINS e	CONTROL GROUP GAINS c	DIFFERENCE e - c	RANK OF THE DIFFERENCES +	RANK OF THE DIFFERENCES -
A	34	13	21	7	
B	8	- 2	10	3	
C	4	28	-24		8
D	42	42	(0)		
E	37	- 1	38	12	
F	1	- 8	9	2	
H	- 6	-11	5	1	
I	- 2	12	-14		4
J	28	59	-31		2
K	36	9	25	9	
M	8	41	-33		10
N	27	- 8	35	11	
O	42	25	17	5½	
Q	39	22	17	5½	
			N = 13	T = 24	

TABLE IV Wilcoxon Matched-Pairs Signed-Ranks Test of research data scheduled in appendix E.

* Pairs G, L and P were rejected by the Transfer Retention Test.

The statistic T = 24 is the sum of the ranks of differences with the smaller sum. Reading from a table of critical values of T, with a sample size of 13 (i.e. N) it will be seen that a T of 21 or less is required for significance at the 0.05 level (two-tailed test) when N = 13. Since the obtained T was 24, the null hypothesis can not be rejected at this level of confidence. The hypothesis may therefore not be accepted on the basis of these data. It is clear though that there was learning. Of the 28 subjects, 21 showed gains. Large gains (i.e. >10) were were 8 in the experimental group and 8 in the control group. More than half of all the subjects learned quite well, therefore differences due to the advance organizer were relatively small.

5 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the research

The aim of the experiment was to ascertain whether a learning programme that is organized to accord with Ausubel's theory of subsumptive reception learning would be more effective than if it were presented without the advance organizer.

A supplementary question was whether the 'organizing concept' could be learned successfully by using the guided discovery methods of a simulation game. A transfer retention test (TRT) was used to indicate successful learning of the organizer concept; that is, the independent variable. A contingency test of Fisher's (appendix F) was used to test for statistical significance of the TRT results.

Linking the two problems - meaningful discovery learning of the organizer and meaningful reception learning of the material subsumptive to the organizer - there are assumptions about processes of sequential transfer in the acquisition and cognitive structure of retentive learning. Ausubel's theory postulates that subsumptive structuring of the expository learning material by the teacher, enables students to learn meaningfully and not by rote or "representationally", as can so easily happen in classrooms.

The hypothesis, again, is that participation by students in a simulation game is effective in causing improved achievement scores in a test of retention of reception learning material, where the reception learning is preceded by the enactive use of organized learning material in the simulation which cognitively subsumes the concepts in the reception learning material.

From a population of 38 students - the 1983 Business Economics (Education) I class for the Higher Diploma in Education at the University of the Witwatersrand - a sample of 34 subjects was matched in pairs on achievement scores of the pretest, mental alertness, abstract reasoning, sex and age.

The research design is an experimental pre/post test control group design with a single experimental variable. Two matched groups of equal numbers of subjects were used. The research paradigm is represented in figure 7 in section 3.1 above. The pretest is represented by O_1. R represents the random allocation of matched pair mates into either of the control or the experimental groups. The independent variable X - that is, the organizer material - was presented to the experimental group only. The TRT, O_2 and O_3, was used to ensure mastery of the organizer before presenting the subsequent reception learning material. Gains in retention were measured for comparison, by the respective increases in postscores: O_4 (experimental) and O_5 (control), as against the prescores O_1. The Wilcoxon matched-pairs signed-rank test was used to test the significance of the hypothesized relationship of X the organizer, to Y the dependent variable (retention of subsumptive material).

5.2 Research Conclusions

The test of the hypothesis was inconclusive. The null hypothesis was not rejected within the 0.05 level (on a two tailed test) by the Wilcoxon matched-pairs signed-rank test.

The supplementary question as to whether the organizer could be learned successfully by means of the simulation game was more clearly resolved. Fisher's contingency test indicated that the probability of the observed results of the TRT occurring by chance (if there were no significant difference or association) to be 1 per cent or less. It is therefore highly probable that the experimental subjects attained or reinforced a knowledge of the organizer concept as a result of their participation in the simulation game.

Whether the organizer concept (learned by guided discovery) is in effect an advance organizer was the question on which the hypothesis was formulated. From the test of the hypothesis, if confirmed, it may be deduced ex post facto, that the TRT did indeed test for sequential transfer of retentive learning and that it was not simply a test of retention. But, since the empirical data were not adequate for the acceptance of the hypothesis, any claim to predictive validity for the TRT and also the sequential transfer potential of the organizer material, remain in doubt. The possibility of these results being due to chance fluctuations in controlled variables, or due to the intrusion of uncontrolled variables can not be ruled out.

5.3 Recomendations

5.3.1 Action research

A distinction is drawn by Cohen and Manion (1980 pp 174-178) between action research and applied research. The research here reported has more in common with what they define as action research, than with applied research. While both kinds of research utilize the scientific method, applied research, Cohen and Manion (ibid) say: 'does not claim to contribute directly to the solution of problems', as action research does. In action research: 'the emphasis is not so much on obtaining generalisable scientific knowledge as on precise knowledge for a particular situation and purpose'. Also, in common with action research, the programme treated in this research report is self-evaluative - the ultimate objective of the teacher-researcher is to improve practice from within the ongoing situation. In this case: in a particular classroom situation and for the purpose of more effective reception learning of certain economic concepts.

Cohen and Manion (ibid) include among the purposes of action research in the classroom situation, that: 'it is a means of remedying problems diagnosed in specific situations, or of improving in some way a given set of circumstances'; and that 'it is a means of injecting additional or innovatory approaches to teaching and learning into an ongoing system which normally inhibits innovation and change'.

Although action research may be done by a team of researchers, it is also possible where 'there is a single teacher operating on his own with his class'.

The research in this report conforms with action research to the extent that the researcher alone is also the teacher of the learning programme. The research is concerned with a particular situation and does not claim general validity. The scientific method, though, remains in force. Experimentally controlled variables are identified; internal validity is striven for; and the hypothesis is tested experimentally.

As with action research, this enquiry into meaningful reception learning does not end with the testing of theories. It focuses on specific problems in a specific situation with the purpose of improving a learning programme.

The test of the hypothesis in this case was inconclusive. So, while this research does not support Ausubel's theories, it does not reject them either. Short of rejecting Ausubel's assumptions - together with a sizeable body of learning theory with which they are logically consistent - two courses of action are possible: firstly, revision of the learning programme to avoid any deviation from the theoretical assumptions that may have occurred; and secondly, to consider the reformulation of hypotheses for the testing, empirically, of the assumptions.

5.3.2 Analysis and improvement of the subsumptive reception learning material

There is evidence in the research data that the organizer concept was (within the specifications of the transfer retention test), learned retentively.

The sequential transfer from the organizer concept to the reception learning material which was exposited orally after the simulation game, is in doubt. This raises the question as to whether the conceptual structuring of the reception learning material was indeed subsumptive to the organizer concept.

This sequential organization, Ausubel and Robinson (1969 p 171, say: 'involves considerations of logical task analysis, progressive differentiation, developmental level of cognitive functioning, integrative reconciliation, and learning hierarchies'.

Exposition of the reception learning material in written form, as well as orally, could possibly, also increase the effectiveness of sequential transfer.

5.3.3 Restatement of hypotheses

The single hypothesis of this research; linking reception learning, through the organizer, to a discovery learning process; could be split into two hypotheses. With a less elaborate sequence of learning experiences, there could possibly be better control over the variables.

That the advance organizer material can effectively form part of a simulation, for meaningful discovery learning, is the gist of one hypothesis. The sequential transfer potential of the advance organizer and the structuring of the subsumptive reception learning material, is the basis of another hypothesis.

Ausubel and Robinson (1969 pp 486) point out that just as verbal reception learning can be meaningful and is not necessarily "empty verbalism"; so discovery learning may not always be meaningful, but could be incorporated arbitrarily and non-meaningfully into cognitive structure. Combining the two issues into one hypothesis does not therefore guarantee meaningful learning of the organizer concept. Part of the validity of the transfer retention test is its capacity to test for meaningful learning of the organizer.

5.3.4 An illuminative evaluation

Unanticipated and possibly uncontrolled variables of which the researcher is not aware may affect the dependent variable. An illuminative evaluation of the learning milieu could possibly reveal such influences.

6 EVALUATION

6.1 Selection of an Evaluation Strategy

From recent trends in curriculum evaluation, Lawton (1980 p 111) identifies six overlapping modes:

1 The classical research model, also called the agricultural-botany paradigm.

2 The research and development - or industrial factory - model.

3 The illuminative model - anthropological and responsive.

4 The briefing for decision-makers, or political, model.

5 The teacher as researcher, or professional model.

6 The case-study, or eclectic portrayal method.

The strategy chosen for the evaluation of the learning programme that was researched, is that of illumination. The reason is that it is likely to complement the research findings best by virtue of its capacity to reveal issues that are not prescribed or anticipated in the research design. Illuminative evaluation may also facilitate in an ongoing way, the professional or 'teacher as researcher' approach (recommended above 5.3.1), by the in-depth information on the learning situation that it provides for the action researcher.

The 'research and development' and the 'briefing for decision makers' models of evaluation are both considered to be inappropriate for the purposes of this inquiry. Considering first the

R and D (research and development) model, it has been anticipated in its research functions by the classical experimental design that was used to research the learning programme. The developmental purposes of the model are inappropriate for the situation-specific intentions of the teacher as researcher. The logical extension of the R and D model is its R, D and D form for general curriculum dissemination. In this research, the teacher-researcher, personally, takes professional responsibility for classroom practice and is not, as in the R, D and D model, merely a receiver of materials produced by outside experts. The 'briefing for decision makers' model is also inappropriate, since, in this case, the teacher-researcher is the decision maker.

The illuminative model of evaluation seeks to interpret the learning milieu by means of responsive techniques. In its approach to revealing information it is not pre-ordinate as it does not depend entirely on the deductive techniques of the scientific method. Its techniques are allied more closely to those of anthropological investigations. While the aim of the briefing for decision makers model is to make recommendations, the illuminative model, on the contrary, is deliberately not prescriptive. Parlett (1970) says of the illuminative approach:

"investigators should not make decisions; but instead should help policy-makers to do so, by throwing light on the implications of different policies, by challenging stereo-typed

thinking and by communicating their specialised knowledge and insight"

Considered together, the use of the experimental research design and an illuminative evaluation, the study is undeniably eclectic. There has been no deliberate intention however, of producing a case study.

6.2 The Evaluation Procedure

The illuminative evaluator, although not a maker of decisions, Parlett (1975) says: should not pursue the study from an 'outside' position. In this particular study the writer has the roles of teacher, researcher and evaluator bestowed single handed upon him.

Dachs (1982 p 37) sums up five separate but associated stages that Parlett (1974 pp 13-18) deems necessary in illuminative evaluation. The first, Dachs says is that 'a general strategy must be established to clarify the type of study and report required'. Section 6.1 above largely fulfils this purpose. It remains to be stated in this context that the brief of this report is a submission to the Faculty of Education of the University of the Witwatersrand, in part requirement, for the degree of Master of Education. In the role of evaluator, the writer is conscious of the need for illumination and that to this end there should be no prescription of variables but rather a responsive awareness from within the learning milieu. It is accepted as a limitation of this method that the quality of the study will be affected by the presence and demeanour of the evaluator. The combination of roles of the evaluator and the

the time constraints of the M Ed course are also important factors which have a bearing on the quality of the evaluation.

In the second stage, Dachs (ibid) says: 'the evaluator undertakes the laborious task of familiarising himself with the day-to-day realities of the curriculum and becoming knowledgeable about the total scheme'. As teacher-researcher, the evaluator already has an intimate, if idiosyncratic, knowledge of the learning situation. In this study, the evaluator's knowledge is widened and made more objective by gathering information from student assessments (appendices A and R); psychometric tests of mental alertness and abstract reasoning; research results (section 4 and appendices E and F); and an initial questionnaire (appendix Q).

By stage three, particular issues can be identified for more intensive enquiry. The first questionnaire (appendix Q) was presented a second time to record changes in the students' opinions. A further questionnaire (appendix T) focusing on issues revealed earlier, was returned by the students. Further information was obtained from the students in a tape recorded classroom discussion at the end of the learning programme (appendix U).

Cohen and Manion (1980 p 206) say that: 'triangular techniques in the social sciences attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint and, in so doing, by making use of both quantitative and qualitative data'. In the process of focusing on particular issues, triangulation is used - analogous to the trigonometrical techniques used in navigation whereby an objective is pinpointed by

taking bearings on more than one landmark or astronomical sighting.

Regarding Parlett's last two stages in the evaluation, Dachs (1982 p 37) says:

"In stage four, the organising and ordering of descriptions, interpretations and explanations is undertaken. The prime purpose during this stage is to highlight the areas of major concern as revealed by the participants. In the final stage, the written report is produced reflecting not only the sensitivity of the evaluator to the needs of his audience but also his ability to provide an overview in which his personal views are neither concealed nor evangelised'.

6.3 The Evaluation Report

6.3.1 Introduction

An awareness of two aspects of the curriculum should help the reader to integrate within the main structure of the learning programme, some of the finer details that will follow. It is assumed that the reader is already aware that the learning programme was designed for experimental research to test an hypothesis. These conditions for scientific control were a major influence on the learning milieu. The two other major background features now to be considered are firstly, the ethnic and cultural characteristics of the students and the evaluator who was also the teacher- researcher. Secondly, the scheduling of the learning programme.

6.3.1.1 Cultural background

Each student was asked to disclose confidentially, for the experiment, his or her date of birth and to note down whether male or female. Data were not asked for on cultural variables such as: place of birth, home language, religion, schools attended, place of residence or government race classification. It was assumed for research control purposes that prescores on the test of achievement (appendix A), which had relevance to economic concepts in the cognitive domain, would adequately control outcomes of these cultural variables in so far as they were likely to affect the experiment. The teacher-researcher was reluctant to probe, needlessly, politically sensitive issues which could possibly cloud the research questions; and did not wish to invade the individual's privacy.

In reflecting, for evaluative purposes, upon the learning milieu, considerations of the affective domain - especially with regard to motivation and interpersonal relations and group dynamics - were as prominent as the cognitive considerations of gains in reception learning of economic concepts - the latter being the point of the research.

Lacking a more detailed record of the cultural characteristics of each student, the writer's general impressions must suffice to inform the reader. These will of course be coloured by his own male, South African, protestant, anglo-saxon social position and be tempered by his status as a member of the academic staff of

the University of the Witwatersrand, Johannesburg. These are hopefully disciplined in knowledge of values emanating from the Faculty of Education of the same University.

Apart from the use of psuedonyms in the discussion as recorded in appendix U, it was decided - for reasons of clews and Bombay ducks - not to identify students by their own or any other names. In the first instance, to maintain confidentiality and in the second, because psuedonyms, in the circumstances, could mislead rather than give clues to the personalities of the students. The majority of the students have Asian names and the evaluator does not have the nous to make subtle distinctions in substituting for names that may have either Hindu or Moslem connotations. Furthermore, some of the Asian students have Christian backgrounds. Home languages could be any of Gujerati, Urdu, Hindi, Tamil, Telegu or English. The proficiency of Asian students to express themselves in English, as for the other students, ranged from very good to very poor. Some of the Asian students were however, clearly struggling in a language in which they were not entirely comfortable. See appendix U, for example lines 85 to 103. Religion did have some bearing on the learning milieu, as some of the Moslem men students, appropriately attired, left promptly at 12:30 p.m. for prayers while other students remained during the mid-day break to complete their work in their first attempt at the simulation game.

The minority of the students, whom I shall designate as European (including those classified by the government as 'coloured') for reasons of culture rather than race or nationality, comprised further minority characteristics: white, coloured, protestant, catholic, native South African, immigrant, Jewish, Portuguese and Italian. There were no black Africans. A coloured student disclosed that his home language was

English although Afrikaans was spoken at the school he attended. It is pertinent to note that the class was a fairly harmonious meeting of a rich diversity of cultural influences.

In an effort to convey to the reader something of the personality of each student referred to, the following codes will be added to the number that identifies them: A if Asian, or E if European (as defined above); F or M according to sex; and the final two digits represent age in years, for example 23EM20 or 11AF18.

6.3.1.2 The learning programme and student absences

The schedule of the experiment and the learning programme is shown in appendix F. Absences by students that were noted are shown in appendix V. A register was not taken on April 21 & 26, nor on May 13 & June 3.

6.3.2 Salient issues revealed in the learning milieu

An abundance of information about the learning milieu came out of: the research data; students' responses to questionnaires and interviews; and also from records of events in the learning programme. It was not possible to follow up all the avenues of enquiry that were revealed during the course of the evaluation. Due to constraints, mainly of time, only three issues were focused on: firstly, the organisation of the simulation as the students perceived it; secondly, the 'organizer' effect against wider questions of transfer from the discovery learning experience to the reception learning of the expository lectures; and thirdly, the question of how well students attended to the learning programme.

6.3.3 Organization of the simulation game

Firms were simulated which would tender bids for the contract to supply the natural monopoly telephone service. Students responded differently to questions as to how long it took to organize the class into firms and as to how well they were organized as working groups. Most said too much time was spent, one said too little time and some thought the time spent was about right. Nearly all the students thought there were better ways of allocating students to firms and of introducing the learning material. In explaining why they thought as they did, they revealed certain other issues related to the way the simulation game was planned, organized and managed. These issues concerned choice of partners to work with; perception of the objectives of the discovery learning stage; collusion among competitors; and reactions to poor attendance of fellow students which affected the learning situation.

Some responses by students who considered that too much time was spent : 1AF36 said that 'more co-operation should come from us as students, when something has to be done'. 3AM20 also thought: 'we, the students, should have been more co-operative. Plenty of time was wasted on talking and idealness!' (sic). It was suggested by 18AM24 that the preliminaries could have been completed more quickly: 'By more coorperation (sic) from a few students'. The response of 13AM18 was: 'I think most of us were organised apart from few people that acted foolishly which was time consuming'. Delays were also attributed to absences and late arrival of students, as summed up by 14AF20: 'I think that if all the students in the class

had attended regularly and had come early for the simulation game, we would not have wasted so much time getting ourselves organised'; and 31AF18 said: 'Students were either late or absent, with the result they had to be informed thus causing delay for others'.

Although students blamed classmates, the ensuring of experimental controls was also a factor contributing to time consuming preparations. The evaluator, in the capacity of teacher-researcher was aware of restlessness among students unoccupied while the process of allocating them to firms was in progress. Aside from the additional cost that it would entail, the solution suggested by 34AM19 is a good one: 'I think that the circular (appendix M) which was read out, should instead be given to every group to read for themselves'. Firms had to be drawn from either control or experimental group subjects. The students, not being aware of the experimental controls, were in some instances frustrated in their choice of partners for their firms. Firm number 10 for example (appendix D) was an unhappy remnant of two students, 30EF18 and 37AM18, who did not actually in the event work together. They could more happily have been incorporated into two other firms with experimental subjects. What should happen, suggested 29EM19 and many others, was: 'Allow the players to organise <u>themselves</u> into groups, since this took the most time with our simulation game. Normally it is better to let people form their own groups. Then friends in different groups are less likely to "compare notes" and competition and <u>learning</u> would be more effective'. So, to some extent attempts to isolate experimental variables from control subjects may have been ineffective.

Two students, 3AM20 and 8EF19, said that the time spent on getting organized was about right. 3AM20: 'People should have been allowed to choose who they would like to work with'; and 8EF19: 'The first time something is done it always takes longer, as one is unsure of how to go about it. One dissenting voice 9EM26 responded that too little time was spent on getting organized. He said: 'By a clear previous explanation of broadly what we are looking for and how to establish that', the preliminaries could have been done more quickly.

There was considerable comment on the use of objectives and by whom they should be set, for the guided discovery learning situation, but this issue was not explored due to lack of time to do it justice.

6.3.4 The organizer effect and transfer of learning

Whether students were in the control or the experimental group is of interest here. According to the research results, virtually all of the experimental subjects, in advance of reception learning, acquired a knowledge of the organizing concept - price elasticity of demand - if not previously, at school for example, then presumably in the simulation. The control group subjects not exposed to the organizer material did not acquire this concept in advance of the expository lectures on this topic. Responses in the evaluation, however, reveal that some of the control students were able, retrospectively, to relate their reception learning of the expository material to their prior experience of the simulation game. It appears that vertical (quod vide 2.13) or lateral (quod vide 2.14) transfer could have ocurred between the simulation and the reception learning situation. Vertical as a result of prior learning at a lower hierarchical level, and lateral where transferable skills or knowledge of real-life situations were involved.

In order to distinguish experimental group subjects from those of the control group, the letters E or C are now prefixed to the coding used so far: for example E38AM20 - experimental student number 38 Asian male aged 20 years.

E38AM20 was one of the experimental group subjects who did not pass the transfer retention test (TRT) and was therefore deemed not to have acquired the organizer concept - an exception among the experimental subjects (appendix E). He made a revealing comment: 'The actual explanation of price elasticity of demand only came after the simulation was done. Thus we did not have much knowledge of it'. This accords with his TRT result. In response to the question (T9): 'Was there any link, that you were aware of, between the simulation game and the lectures that followed on price elasticity of demand?'; he answered: 'Yes. The problems encountered in the simulation seemed to be easier to answer after the lectures that followed'. In an interview with the evaluator he was then asked: 'Do you think the lectures should have been before (instead of after) the simulation?' He responded: 'Yes. Because the simulation was about price elasticity of demand'. He had first encountered the concept, but not understood it, in the reception learning stage. He did not recognise it in the simulation material. He felt he should have been told the concept before the simulation: 'Student should be supplied with a little more information before starting with the actual game' (T3); and: 'It was not explained in any detail. A little more explanation was required' (T7). The dialogue between E38AM20 and the evaluator in appendix W confirms that he did not learn the organizer concept through the discovery material of the simulation. His post test answers (appendix A Part A) showed that he

was not able to define elasticity or to distinguish between 'elastic' demand and 'perfectly inelastic' demand. If he had attended the second performance of the simulation game he might have passed the TRT along with all the other experimental subjects. (Appendix E) His post test achievement score was equal to that of his matched-pair mate in the control group, which is as would be expected since neither had the benefit of sequential transfer resulting from subsumptive structuring of the learning material within the organizer concept. (Appendix E)

A control student C32EM19, who acted as leader in the firm that tendered the winning bid, said that 'The simulation resulted in understanding of price elasticity of demand being a bit confused (T8). As may be expected from one who was not exposed to the organizer material, he commented: 'The lectures were more effective, as the simulation game mainly taught me of monopolies and competition'. He indicated that he was not aware of any link between the simulation and the lectures that followed (T9). When he was then shown the organizer material that the experimental subjects were exposed to, he said: 'Yes, then I see the link'. Most revealing was his response to the question (T9): 'If you answered "no", can you suggest any way in which the simulation could be linked to the lectures on 'price elasticity of demand' so as to make it easier to understand this concept?' His response, before he had seen the organizer material, was: 'I think maybe the Drawing of Curves in the simulation game and more emphasis (emphasis) on the mathematical section'. Assuming that he did not 'compare notes' with the experimental students and see the organizer material, it appears that he was able to transfer laterally the concepts learned by reception to the simulated situation. He said

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that he had not seen the organizer material before. His answers to Part A (appendix A) of the pre-post test show that whereas before he had no knowledge of the concept, he did after the reception learning stage have at least a representational "knowledge". (See figure 4, section 2.16, page 60)

Comparison of the responses of two experimental group students demonstrates the meaningful and non-meaningful phenomena of discovery learning. Experimental group student E31AF18 said that the simulation resulted in a very much better (appendix T, 8) understanding of price elasticity of demand. She commented: 'I gained a better understanding of p. elasticity & demand'. This is borne out by her pre/post test answers. She said she was aware of a link between the simulation and the reception learning material: 'The relationship bet. demand & supply was evident in the game & in lectures'. As in the case of student E30EF18, below, she passed the TRT. They differ in that she appears to have acquired a meaningful knowledge of the organizer concept. This was not the case with student E30EF18. A re-examination of the TRT of E30EF18, appendix X, shows that she was given the benefit of the doubt of an ambiguous answer, as indicated by the marker's question mark. On reconsideration of her answer it appears that she did not understand the contradictory use she made of the equation E = 0. (Appendix X) The section of the curve indicated as E > 1 and marked correct, also, is actually not correct. She did not in fact pass the TRT She commented that the simulation resulted in somewhat better (appendix T, 8) understanding of the concept. This is belied by her achievement post-score which was 2 less than (or practically equal to) the prescore. In Part A of the pre/post test (appendix A), she advanced from nought to the full 12 marks allocated to this section. It seems, non-meaningful learning is a possible explan-

ation for these results. Her comment that: 'I understand a little more about the changes in prices and demand and what causes this', is not manifest of an understanding of the concept of elasticity. She said that she was aware of a link between the simulation game and the lectures, but when asked to specify what this link was, she gave the somewhat contradictory answer: 'This was actually explained more clearly in the lectures'. It is reasonable to assume that her representations of the organizer concept were non-meaningful outcomes of rote learning, in view of her lack of gain in achievement of the subsumptively organized concepts of the reception learning material. Non-meaningful learning of the organizer concept is not surprising in view of her absence from an introductory lecture given prior to the simulation to acquaint the students with the terminology they would encounter in the simulation. (Organizer - appendix I. Absences - V.)

A comparison of the responses of two control group students, C29EM19 and C14AF18, suggests that vertical transfer of learning occurred in the case of certain students. It may explain why some of the control group students - without the benefit of the advance organizer - were able to achieve relatively large gains in learning the reception material. (Appendix E) As in the case of C32EM19 discussed above, these students it appears were able to organize the subsumer concept from the subsumptive concepts of the reception material, by their own processes of generalization and abstraction. They were able, their responses suggest, to organize cognitive structures with the aid of their enactive experience of the simulated market situation. Their learning of the reception material could therefore have been at the

higher levels of 'application', 'analysis' and 'synthesis' (see figure 4 in section 2.16), that is above and including the 'comprehension' level of reception learning. The possibility appears to exist that a simulation game per se, without the organizer material, may also be effective for some students, in facilitating lateral as well as vertical transfer of learning. If so, these variables were not eliminated from the research design.

Student C29EM19 responded (to appendix T item 8) that the simulation resulted in understanding of price elasticity of demand very much better. C14AF18, on the contrary was very confused, but said: 'this problem was resolved when repeating the simulation game'. She added: 'With regard to the first simulation game I can say I was totally confused in understanding "price elasticity of demand".' Student C29EM19, after the repeat of the simulation said: 'The game not only showed what it (elasticity) was but also showed exactly what it meant for the entrepreneur'. These comments were made by control students after the intervention of the reception learning material. Both students had not passed the TRT, yet they said that they had since become aware of a link between the discovery and reception stages of the learning programme. She (C14AF18) said, indicative of meaningful learning, that: 'Both the simulation game and the lectures stressed on the idea of measuring the degree of responsiveness or sensitivity of consumers to a change in price of a product'; and he (C29EM19) said: 'The lectures which followed made expository learning easier because the game, which involved heuristic learning, was the exact same thing'. (Questioned about his use of the words "expository" and "heuristic", he said that

he had spent a year at the Rand College of Education before enrolling at the University). They both achieved gains in the post test on their prescores (appendix E). Asked when she associated the word 'elasticity' with the concept, C14AF18 said: 'In the second simulation'. Asked where she had encountered the the word 'elasticity' in its economic sense, since it was not included in the control group's simulation learning material (appendices K and L), she replied that she remembered it from the pre-test (appendix A). Asked whether she knew the economic meaning of the word at the time of the pre-test, she answered: 'No.' This was confirmed by the totally incorrect responses she gave in the pre-test (appendix A Part A). Whereas in the post test she could define the term and had partial success in explaining the difference between demand that is 'elastic' and demand that is 'perfectly inelastic' to price changes (she was hampered by poor expression in English). Student C29EM19 was able to define and to explain the concept in the post-test whereas in the pre-test he scored nought on these questions. The same pattern of events was demonstrated here as with control student C32EM mentioned earlier. In the absence of sequential transfer through organized (in advance) subsumptive structuring of the learning programme, vertical and leteral transfer of learning, it appears, between the simulation experience and the later reception learning occurred.

6.3.5 Attendance by students

Many of the students were fairly frequently absent from lectures as appendix V shows. Others who were assiduous in body were not mentally attentative to the learning programme. See appendix U, lines 15 to 33

and 349 to 352. Student C29EM19 commented: 'The people in some of the groups tendered (sic) to leave the work to one or two people in the groups and just accepted whatever the group done'. 25AM19 said: 'In my group, I found that while I understood the game, my partners had no idea of what was going on. Also they seemed to be disinterested.' Some of the firms did operate as entities. E37AM18 commented: 'Every individual had a different opinion, this made the game more interesting in deciding the bid. Working together we learned from each other'; E31AF18 said of working in firms: 'It promoted group co-operation'; and E22EF19 said: 'Because in business usually one does not make decisions alone, but with other members of the firm'.

Following below are a representative selection of responses to the question: (Appendix T, 17)

"Only one student was absent when the posttest was written, whereas at the lectures before and after the simulation and for both simulations, several students did not present themselves. To what do <u>you</u> attribute the better attendance for the posttest?"

E31AF18: 'I don't know, maybe they were BORED'. E22EF19: 'Obviously they understood it & didn't want to waste time doing simulations again etc. They just came to write the test'. E12AM19: 'It being part of the year mark'. C29EM19: 'The fact that it was for marks which affected your year mark (i.e. the post test)'. C25AM19: 'To the mere fact that they felt they had to attend and write the posttest'. E8EF19: 'I think maybe the students wanted to see if they really know what is going on or not'. C18AM24: 'People are under the influence that lectures do not have any importance'.

6.3.6 Conclusion

This evaluation has thrown light on possible reasons why the experiment gave inconclusive results. These are: non-attendance and non-participation by some students; collusion possibly between ostensibly competing experimental and control subjects; transfer of learning other than by sequential transfer of the organizer structure; and English language deficiencies which impeded students' ability to express themselves.

The pair-matching and random allocation of subjects to control and and experimental groups would tend to ensure that these variables applied equally to the experimental and control groups. This tendency would have the effect of blunting the efficiency of the research design by reducing the experimental variable in favour of the nul hypothesis that there are no differences between the two groups. With better control of the variables identified by the illuminative evaluation, there remains the possibility that the nul hypothesis may be rejected.

There was evidence of sequential transfer of learning from the organizer concept to the learning of reception material, but not at a sufficiently high level of statistical significance, to be sure that student achievement gains were not possibly due to other causes.

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APPENDIX A

TEST: Elasticity of Demand STUDENT: _____ DATE: _____

Please record your date of birth _____19___; and whether male or female.

PART A (Answer both questions in the spaces provided below)

1 Write a paragraph (not more than 6 lines) explaining what the word 'elasticity' means in the context of market demand.

_____

_____

_____

_____

_____

_____

2 State briefly (not more than 12 lines) the essential difference between demand that is 'elastic' and demand that is perfectly 'inelastic'.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

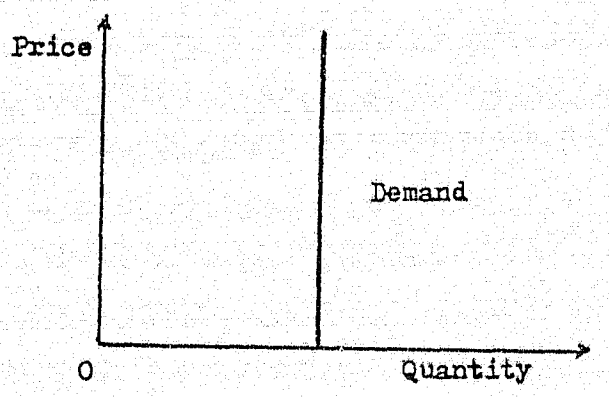
_____

Note well: Part A of this test will be taken-in ten minutes after the commencement of the test. Go on to Part B without delay.

TEST: Elasticity of Demand STUDENT: _____ DATE: _____

PART B Multiple Choice Test Instructions: Each question has only one correct answer. Indicate the correct answers by circling one of the letters A, B, C, D or E for each question. Mark your answers on the question paper. Incorrect responses will be penalized by a mark of -1. Each correct answer will be awarded 4 marks. If you are not sure of an answer, leave it blank.

Figure 1 shows a demand curve.



1 The conditions represented in figure 1 are those in which

A elasticity of demand cannot be evaluated.

B elasticity of demand is unitary.

C elasticity of demand is perfectly elastic.

D demand is perfectly inelastic.

E demand is fairly elastic.

2 The elasticity of the demand curve in figure 1 (η) has a value of

A $\eta = 1$

B $0 < \eta < 1$

C $1 < \eta < \infty$

D $\eta = 0$

E $\eta = \infty$

Table I	Change	Price	Quantity
	from:	50c	300
	to:	45c	500

3 In table I, the change in quantity is

A 60%

B 40%

C 66,6%

D 11,1%

E 10%

4 In table I, the change in price is

A 60%

B 40%

C 66,6%

D 11,1%

E 10%

Table II	Price per unit	Quantity demanded
	3c	250
	4c	200
	5c	100
	6c	50

The amounts in table II are from a demand schedule.

5 When price increases from 4c to 5c elasticity of demand measures

A 2,0

B 1,5

C 1,0

D 0,75

E 0,5

6 Where a demand condition is perfectly elastic, its value is

A infinity.

B greater than one but less than infinity.

C equal to one.

D less than one.

E zero.

7 The demand for products that are habit-forming such as tobacco and liquor is likely to be

A infinitely elastic.

B relatively elastic.

C of unitary elasticity.

D relatively inelastic.

E absolutely inelastic.

8 The price per unit of a good at a certain time is 10c when a fall in price of 1c occurs. As a result of this price change, demand for the good increases by 25 percent. Hence it may be said of demand for the good:

A It is inelastic.

B It is very elastic.

C It is infinitely elastic.

D It has unitary elasticity.

E None of the above (ABCD) is true.

9 "A given relative change in price causes quantity demanded to change by the same relative amount". This statement describes

A perfect elasticity.

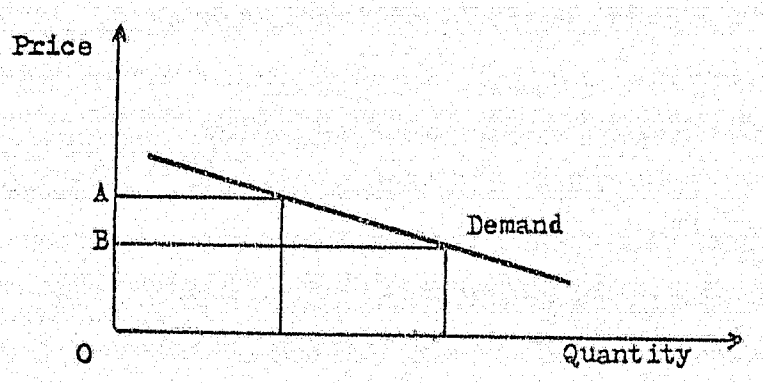
B perfect inelasticity.

C unitary elasticity.

D relative inelasticity.

E none of these (ABCD).

Figure 2 shows a demand curve



10 The numerical measure of elasticity of the price change from OA to OB represented in figure 2 is

A $\eta = 1$

B $0 < \eta < 1$

C $1 < \eta < \infty$

D $\eta = 0$

E $\eta = \infty$

11 If in time of drought and severe shortage of water, the authorities expect considerable relative reduction in water consumption as a result of a moderate relative increase in the water tariff, there is an implicit assumption that the demand for water is

A perfectly inelastic.
B very elastic.
C fairly inelastic.
D perfectly elastic.
E none of these (ABCD).

12 If in time of drought and severe shortage of water, the authorities consider it necessary to double or even treble the rates charged for water, simply to achieve a relatively slight reduction in total consumption, an assumption is thereby implied that the demand for water is

A perfectly inelastic.
B fairly elastic.
C very inelastic.
D perfectly elastic.
E none of these (ABCD).

13 Which of the following statements is <u>not</u> true?

A Elasticity of demand is important to the supplier because of the way it affects sales.

B The quantities of a good that a firm should plan to produce, considering price changes, are affected by the elasticity of demand for those goods.

C The gross income of a firm depends on the value of its sales turnover.

D Gross sales income is equal to the price per unit sold multiplied by the number of units sold at that price.

E The revenue from sales of an individual who is not a monopolist, is always equal to the total consumer expenditure in the market.

14 "Where elasticity of demand is greater than one: a fall in price will __(a)__ total expenditure; and a rise in price will __(b)__ it."

A (a) increase (b) decrease
B (a) increase (b) increase
C (a) decrease (b) increase
D (a) decrease (b) decrease
E (a) equalize (b) equalize

15 Demand for very expensive (highly priced) motor cars tends to be __(a)__ elastic than that of popular models. In the former case elasticity would tend to be __(b)__ one; and in the latter case __(c)__ one.

A (a) more (b) greater than (c) less than
B (a) less (b) greater than (c) less than
C (a) more (b) less than (c) greater than
D (a) less (b) less than (c) also less than
E (a) less (b) less than (c) greater than

16 One would expect the demand from <u>business</u> people for telephones to be _____ elastic as compared with the majority of <u>households</u> in a country like South Africa.

A extremely
B more
C equally
D less
E unitarily

17 "It is usually agreed that the demand for a good like salt is __(a)__ affected by a change in price. On the other hand, changes in the prices of goods like colour television sets or foreign holidays __(b)__ influence on the demand for them."

A (a) very much (b) do not exert a considerable

B (a) not very much (b) do exert a considerable

C (a) not at all (b) also do not exert any

D (a) very much (b) do also exert a considerable

E (a) not very much (b) exert an equally small

Figure 3(a)

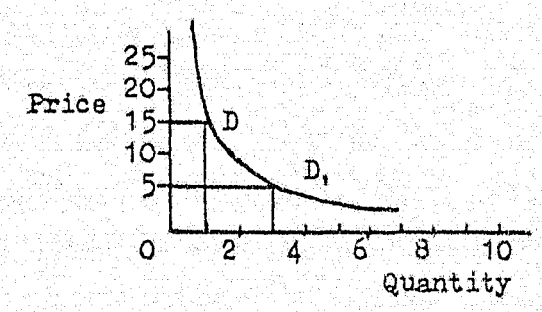
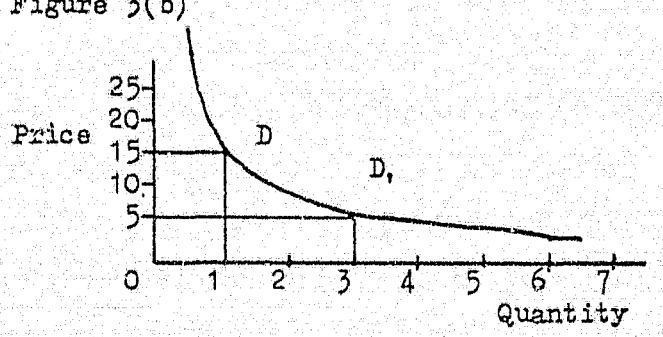


Figure 3(b)



18 Compare figures 3(a) and 3(b); and select the statement that is true.

A Total expenditure at each point D in 3(a) and 3(b) is less than at the respective point D, on the same curve.

B Total expenditure at D, in 3(b) is greater than at D, in 3(a).

C Total expenditure at each point D and D, in 3(a) and 3(b) is the same.

D Total expenditure at point D, in 3(b) is greater than at point D in 3(a).

E Total expenditure at D, in 3(a) is greater than at D, in 3(b).

19 Assuming in each of the following cases a reduction in price:
(a) Whenever numerical elasticity of demand for a commodity is greater than one, the price change will __(a)__ total expenditure on that commodity. (b) Whenever elasticity is less than one the price reduction will __(b)__ total expenditure on it. (c) Whenever the elasticity value is unitary, a price fall will __(c)__ the total expenditure.

A	(a) increase	(b) increase	(c) not change
B	(a) reduce	(b) not change	(c) increase
C	(a) increase	(b) reduce	(c) not change
D	(a) reduce	(b) reduce	(c) increase
E	(a) not change	(b) increase	(c) reduce

Figure 4

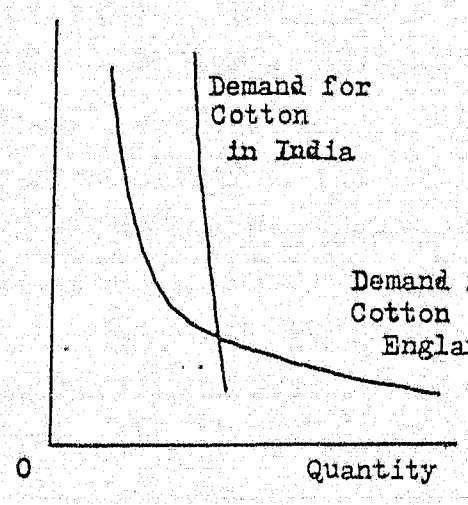


Figure 4 shows hypothetical demand curves for cotton in two different markets.

20 With reference to the demand curves shown in figure 4, which of the following statements is true?

A The demand for cotton in India is much more sensitive to price than the very inelastic demand for cotton in England.

B The price of cotton in England is much more sensitive to quantity demanded than the very elastic demand for cotton in India.

C The quantity of cotton demanded in India is much less sensitive to price than the very elastic demand for cotton in England.

D The demand for cotton in India is much more sensitive to price than the near unitary elasticity of the demand for cotton in England.

E The demand for cotton in England is much more sensitive to price than the inelastic demand for cotton in India.

STUDENT VARIABLES FOR MATCHING OF PAIRS

Student number	Achievement prescore	Mental Alertness stanine		Abstract Reasoning stanine		Sex	Age
1	30	3	(38)	1	(26)	female	36
2	22	4	(46)	5	(50)	male	20
3	22	3	(41)	5	(50)	male	20
4	42	2	(36)	5	(50)	male	20
5	28	2	(34)	4	(46)	female	20
6	32	1	(32)	5	(50)	female	19
7	23	4	(46)	6	(55)	male	20
8	36	4	(47)	6	(55)	female	19
9	61	9	(70)	9	(72)	male	26
10	37	7	(60)	8	(65)	female	19
11	28	1	(23)	2	(36)	female	18
12	35	2	(34)	1	(31)	male	19
13	57	1	(27)	4	(43)	male	18
14	39	3	(41)	3	(41)	female	20
15	24	5	(49)	3	(38)	male	19
16	14	4	(43)	4	(46)	female	21
17	41	1	(27)	4	(43)	female	18
18	28	4	(43)	6	(55)	male	24
19	28	4	(44)	9	(81)	female	19
20	41	1	(22)	2	(35)	female	18
21	17	4	(43)	5	(52)	female	19
22	66	3	(40)	3	(40)	female	19
23	43	3	(41)	3	(41)	male	20
24	44	2	(36)	4	(43)	female	20
25	64	5	(50)	7	(61)	male	19
26	58	2	(36)	7	(58)	female	20
27	33	1	(27)	3	(38)	female	19
28	22	3	(40)	6	(55)	male	19
29	44	2	(34)	5	(50)	male	19
30	41	2	(36)	3	(38)	female	18
31	45	2	(34)	4	(46)	female	18
32	53	3	(38)	4	(44)	male	19
33	28	4	(43)	5	(48)	female	19
34	42	4	(46)	5	(48)	male	19
35	44	5	(50)	7	(61)	female	19
36	50	4	(43)	5	(52)	male	19
37	41	3	(40)	7	(58)	male	18
38	30	4	(43)	4	(44)	male	20

Notes:

1. Variables that are unmatched and eliminated have been underlined.
2. Student number 28 has been eliminated because there was an odd number of male students (after note 1 above).
3. Standard scores are shown in brackets next to stanines.
4. Ages are shown correct to the nearest year.

ALLOCATION OF MATCHED PAIRS TO EXPERIMENTAL AND CONTROL GROUPS

PAIR	SEX		STUDENT		PRESCORE		MENTAL ALERTNESS		ABSTRACT REASONING		AGE		FIRM	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b
A	F			22		66		3		3		19		8
	M		25		64		5		7		19		9	
B	F		26		58		2		7		20		1	
	M			13		57		1		4		18		10
C	M		32		53		3		4		19		3	
	M			36		50		4		5		19		4
D	F			31		45		2		4		18		12
	M		29		44		2		5		19		3	
E	F			35		44		5		7		19		6
	F		24		44		2		3		20		5	
F	M		23		43		3		3		20		11	
	M			4		42		2		5		20		2
G	M		34		42		4		5		19		7	
	M			37		41		3		7		18		10
H	F		20		41		1		2		18		11	
	F			17		41		1		4		18		8
I	F			30		41		2		3		18		10
	F		14		39		3		3		18		9	
J	F		10		37		7		8		19		11	
	F			8		36		4		6		19		8
K	M			12		35		2		1		19		4
	F		27		33		1		3		19		3	
L	F		6		32		1		5		19		5	
	M			38		30		4		4		20		2
M	M		18		28		4		6		24		1	
	F			33		28		4		5		19		6
N	F			5		28		2		4		20		6
	F		11		28		1		2		18		7	
O	M		15		24		5		3		19		7	
	M			7		23		4		6		20		12
P	M			2		22		4		5		20		4
	M		3		22		3		5		20		5	
Q	F			21		17		4		5		19		12
	F		16		14		4		4		21		9	
	TOTAL				646	646	51	51	75	78				
X	M		28		22		3		6		19		1	

SIMULATION GAME - ALLOCATION OF STUDENTS TO EXPERIMENTAL AND CONTROL GROUPS; AND TO SIMULATED 'FIRMS' FOR COMPETITIVE BIDDING

TREBIDIES ISLAND: The Economics of Monopoly Management

FIRM	CONTROL GROUP Student	Pair	FIRM	EXPERIMENTAL GROUP Student	Pair
1	26	B	2	13	B
	18	M		4	F
	28	X		38	L
3	32	C	4	36	C
	27	K		12	K
	29	D		2	P
5	24	E	6	35	E
	6	L		5	N
	3	P		33	M
7	34	G	8	17	H
	11	N		22	A
	15	O		8	J
9	25	A	10	30	I
	14	I		37	G
	16	Q			
11	10	J	12	31	D
	20	H		7	O
	23	F		21	Q

REPRESENTATIVES

19	Investors representative
1	Homeowners representative
9	Businesses representative

Notes: 1 Student numbered 28, in firm 1, marked X, is not matched.

2 Students numbered: 19, 1 and 9, are not matched.

RESULTS OF TRANSFER RETENTION TEST (TRT) AND PRE-POST SCORE GAINS

EXPERIMENTAL GROUP Firm	Student	Pair	Simulation First	TRT	Simulation Second	TRT	Pre-score	Post-score	Gain
2	13	B	present	f	present	p	57	65	8
	4	F	"	f	"	p	42	43	1
	38	L	"	-	absent	f*	30	56	26*
4	36	C	present	f	present	p	50	54	4
	12	K	"	f	"	p	35	71	36
	2	P	"	f	"	f*	22	48	26*
6	35	E	present	f	present	p	44	81	37
	5	N	"	f	"	p	28	55	27
	33	M	"	f	"	p	28	36	8
8	17	H	present	f	present	f/p	41	35	- 6
	22	A	"	f	"	p	66	100	34
	8	J	"	f	"	p	36	64	28
10	30	I	present	f	present	p	41	39	- 2
	37	G	"	f	"	f*	41	38	- 3*
12	31	D	present	f	present	p	45	87	42
	7	O	"	f	"	p	23	65	42
	21	Q	"	f	"	p	17	56	39

CONTROL GROUP Firm	Student	Pair	Simulation First	TRT	Simulation Second	TRT	Pre-score	Post-score	Gain
1	26	B	present	f	present	f	58	56	- 2
	18	M	"	f	"	f	28	69	41
	28	X*	"	f	"	f	22	45	23*
3	32	C	present	f	present	f	53	81	28
	27	K	"	f	"	f	33	42	9
	29	D	"	f	"	f	44	86	42
5	24	E	present	f	present	f	28	43	- 1
	6	L*	"	f	"	f	32	56	24*
	3	P*	"	f	"	f	22	93	71*
7	34	G*	absent	f	present	p	42	67	25*
	11	N	present	f	"	f	28	20	- 8
	15	O	"	p	"	f	24	49	25
9	25	A	present	f	present	f	64	77	13
	14	I	"	f	"	f	39	51	12
	16	Q	"	f	"	f	14	36	22
11	10	J	present	f	present	f	37	96	59
	20	H	"	f	"	f	41	30	-11
	23	F	absent	f	"	f	43	35	- 8

* Pairs rejected - experimental subject failed (f) the TRT; and subject number 28 (X) being an extranumerary unmatched male.

APPENDIX F

SCHEDULE OF THE RESEARCH PROGRAMME

1983					Appendix
April	19	Tuesday	9:30 a.m.	Pretest.	A and B
	21	Thursday	3:30 p.m.)	Preparatory lectures.	G and H
	22	Friday	11:40 a.m.)		
	26	Tuesday	9:30 a.m.)		
	28	Thursday	3:30 p.m.	Introduction and preparation for the simulation.	D and M
	29	Friday	11:40 a.m.	Discovery learning, the first simulation.	I J K L M N O & P
				Questionnaire.	Q
May	3	Tuesday	9:30 a.m.	Transfer retention test.	R
	5	Thursday	3:30 p.m.	Discovery learning, the second simulation.	I J K L M N O & P
	6	Friday	11:40 a.m.	Questionnaire.	Q
	10	Tuesday	9:30 a.m.	Transfer retention test.	R
	12	Thursday	(Ascension Day - public holiday)		
	13	Friday	11:40 a.m.	(Other work)	
	17	Tuesday	9:30 a.m.)	Lecture material for reception learning is presented.	S
	19	Thursday	3:30 p.m.)		
	20	Friday	11:40 a.m.)		
	24	Tuesday	9:30 a.m.	Post test.	A and E
				Questionnaire.	T
	26	Thursday	3:30 p.m.)	(Other work)	
	27	Friday	11:40 a.m.)		
	30	Tuesday	(Republic Day - public holiday)		
June	2	Thursday	3:30 p.m.	(Other work)	
	3	Friday	11:40 a.m.	Discussion for evaluation.	T and U

Author Curits P J D
Name of thesis The organizing effect of a simulation game experienced in advance of reception learning of economics 1983

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